PRELIMINARY: NOT FOR QUOTATION OR CITATION

THE DISTRIBUTION AND DETERMINANTS OF JOB VACANCIES: EVIDENCE FROM THE 2001 EMPLOYERS SKILL SURVEY

Andy Dickerson

Second Draft: January 2003

Abstract

Despite their obvious importance for employment determination and the operation of labour markets, little is known about the distribution, nature or determinants of job vacancies. This paper describes and analyses the results of a large-scale establishment-level survey for England conducted in Spring 2001. It documents the distribution of unfilled jobs and investigates the factors which influence firms' recruitment practices and difficulties in a period of strong labour demand. While there is considerable heterogeneity in the stock of vacancies, it is possible to identify a downward sloping UV relationship between vacancies and the local unemployment rate.

JEL Classification: J2, J6.

Keywords: job vacancies, skill-shortages, labour demand, local unemployment, UV curves.

Acknowledgements: The 2001 Employers Skill Survey was commissioned by the Department for Education and Skills and I would like to thank them for allowing me to use these data. However, they bear no responsibility for the analyses or interpretations presented in this paper.

Address for Correspondence: Andy Dickerson, Institute for Employment Research, University of Warwick, Coventry CV4 7AL. tel: +44 24 765 22672; fax: +44 24 765 24241; email: a.p.dickerson@warwick.ac.uk

Executive Summary

- In contrast to the considerable microeconomic and macroeconomic literature on unemployment, surprisingly little is known regarding job vacancies. This paper uses data from a representative survey in Spring 2001 of over 27,000 establishments in England to investigate the distribution and determinants of job vacancies, with a particular focus on the impact and importance of local labour market conditions.

- At the time of the survey, 14.5% of establishments had at least one vacancy, with 2.7% of jobs unfilled, as compared to the unemployment rate of 4.9%. Due to the tendency for larger establishments to be more likely to have vacancies, 44.2% of workers were employed in establishments that had at least one unfilled job.

- The survey enables general vacancies to be distinguished from those that are hard-to-fill and also those that are unfilled due to skill-shortages amongst the applicants. Approximately 4% of establishments had skill-shortage vacancies, and around 20% of jobs available remained unfilled due to skill-shortages.

- The variation in vacancies between regions is much smaller than the variation within regions. In part, this is a result of such a large proportion of establishments having a vacancy rate of zero irrespective of region. However, even considering only those establishments with some vacancies, (conditional) vacancy rates vary much more within than between regions. The same conclusion holds for within-and-between comparisons for industries and sectors.

- A model is specified for the joint determination of any vacancies (vacancy incidence) and the conditional vacancy rate (vacancy propensity). Firm, establishment, industrial and local labour market characteristics are all found to be significantly related to the vacancy incidence and the vacancy propensity. Differences in vacancy incidence and vacancy rates by establishment size are particularly notable. However, there still remains considerable variance in vacancies that cannot be accounted for by the observable and measurable differences between establishments. This is perhaps unsurprising given that, in aggregate, the stock of vacancies is of the same order of magnitude as the inflow and outflow of vacancies – there is considerable turnover in the labour market.

- Despite the wide variance in vacancy rates, a statistically significant negatively sloped relationship between total vacancies and local unemployment can be identified at the establishment level. While still significantly negatively, this relationship is weaker for hard-to-fill and skill-shortage vacancies in particular. This finding accords with expectations since these are exactly the vacancies that the unemployed are least likely to be qualified for. The negatively sloped UV relationship is strongest and steepest for non-skill shortage vacancies, which comprise the majority of all vacancies as noted above.

THE DISTRIBUTION AND DETERMINANTS OF JOB VACANCIES:

EVIDENCE FROM THE 2001 EMPLOYERS SKILL SURVEY

1. Introduction and Background

In contrast to the considerable microeconomic and macroeconomic literature on unemployment, surprisingly little is known about the distribution and determinants of job vacancies[1]. Yet the supply of job opportunities is clearly crucially important to the understanding why some individuals are unable to secure employment. Moreover, the distribution and character of vacancies provide important indicators of the operation of labour markets. If vacancies are prevalent despite a supply of unemployed individuals, this may be interpreted as evidence of mismatch especially with regard to the skills and competencies of the unemployed and the technical requirements of the unfilled jobs. Alternatively, it could indicate problems with the operation of the local labour market in terms of allocating workers to jobs and jobs to workers – such as poor individual job search effectiveness and/or failures in the recruitment strategies of companies. Other explanations for the coexistence of vacancies and unemployment include: temporal misallocations arising through sluggish adjustment and change especially in periods of rapid workplace developments, which may be exacerbated by more macro-based persistence effects in unemployment; occupational or geographical immobility - perhaps related to local costs, relative wages and rigidities associated with housing ownership and prices; high reservation wages amongst the unemployed relative to the employment opportunities available; and functional differences in the geographical identification of 'local' labour markets (particularly for vacancies) especially in regions with high levels of commuting. Of course, these various explanations may be complementary rather than competing hypotheses for the coexistence of 'jobs without workers' and 'workers without jobs'. Thus the distribution and determinants of vacancies, and their relationship with unemployment can reveal much about the operation of the labour market, particularly perhaps at the local level.

[1] A recent notable exception which examines the propensity for establishments to have skill-shortage and hard-to-fill vacancies, as well as recruitment difficulties, is Haskel and Martin (2001).

At the macroeconomic level, until very recently, the aggregate number of vacancies in the UK was derived from the number of vacancies which had been notified to the Employment Service (ES) by employers who contacted Jobcentres. Occasional surveys have indicated that approximately one-third of all vacancies nationally are thus recorded (and around one quarter of all engagements are made from Jobcentres) [2]. Figure 1 graphs the monthly stock of vacancies series from January 1990 to April 2001. Vacancies are roughly pro-cyclical and are clearly negatively related to the stock of unemployment as can be seen. This aggregate relationship underpins the literature on Beveridge or UV curves. Vacancy inflows and outflows during this period are relatively stable, however, and display little evidence of cyclicality. They both average around 200,000 per month, and thus are of the same order of magnitude as the average stock of vacancies over the period. Since April 2001, publication of the vacancy series has been suspended due to wide-scale administrative changes in the way in which ES records vacancies[3].

This paper utilises data from a representative survey of over 27,000 establishments in England undertaken in Spring 2001 to investigate the distribution and determinants of job vacancies at the *microeconomic* (establishment) level, with a particular focus on the impact of local labour market factors. The survey has two major advantages over the aggregate vacancy series. First, it provides a more detailed and disaggregate picture of vacancies which is representative of *all* job openings rather than just those which are notified to Jobcentres. As Birtwhistle (2001) notes, Jobcentre vacancies are skewed towards the lower end of the market with greater

[2] Similarly, both the US and Canada publish a 'help-wanted index' which records the volume of jobs that are advertised. These aggregate series are clearly useful in the analysis of trends in vacancies and vacancy rates in the absence of any structural changes in the way in which employers' recruitment strategies are operated. However, this may be a fairly bold assumption since recent years have seen a number of significant changes in the recruitment strategies of both large and small firms. For example, the use of the internet for advertising vacancies, and the increasing usage of recruitment agencies will undoubtedly had an impact on the ways in which companies report vacancies. In any event, the aggregate series are clearly a very imperfect measure of the actual number of vacancies.

[3] The introduction of Employer Direct, which involves transferring the vacancy recording process from local Jobcentres to regional Customer Service Centres, has led to a discontinuity in the series. Moreover, figures for Northern Ireland had been unavailable since March 1999 due to problems which arose with the introduction of a new system for processing vacancies there (Birtwhistle, 2001). Finally, ONS has very recently commenced a new quarterly survey of employers to directly measure vacancies in the whole economy (Machin and Christian, 2002).

turnover and are not typical of all jobs (or vacancies) in the whole economy[4]. Secondly, the survey enables general vacancies to be distinguished from those that are hard-to-fill and also those that are unfilled due to skill-shortages amongst the applicants[5]. Clearly, the nature of the jobs available will be an important factor in determining the efficacy and efficiency with which the labour market can fill vacancies.

The first task of the paper is to describe the distribution and type of vacancies that exist as revealed by the 2001 Employers Skill Survey (ESS2001). Establishment level vacancy incidence and vacancy rates are presented, disaggregated across a number of dimensions such as region and industry. The second task is to investigate the determinants of vacancies, and in particular the UV relationship at the local level, while taking account of the characteristics of the establishment and the local labour market which may impinge upon this relationship. It is clear that workforce and workplace factors as well as the nature of the local labour market can all potentially affect the relationship between vacancies and unemployment as depicted in the local UV curve[6].

Thus, as well as documenting the distribution of vacancies, the paper estimates a model for the joint determination of any vacancies (vacancy incidence) and the conditional vacancy rate (vacancy propensity). Firm, establishment, industrial and local labour market characteristics are all found to be significantly related to the

[4] For example, around one third of all vacancies notified to Jobcentres in the year to October 2000 were in the distribution, hotels and restaurant industry.

[5] Skill-shortage vacancies are defined as those that the respondents' state are hard-to-fill because of low numbers of applicants with the required skills, work experience or qualifications that the company demands. For consistency, this is the definition of skill-shortage vacancies used in all previous analyses using the Employers Skill Surveys (see, Hogarth *et al*, 2001, Bosworth *et al*, 2000a, 2000b, *inter alia*).

[6] Conventionally, Beveridge curves are specified with unemployment being a function of the vacancy rate (and other variables) – so that the causality implicitly runs from higher (lower) vacancies leading to lower (higher) unemployment. However, it has been recognised that the causality could be reversed – that where unemployment is low, vacancies may be high because of a shortage of workers, or that vacancies and unemployment may be simultaneously determined. Nevertheless, certainly at the aggregate level, recent research indicates that the potential simultaneity between unemployment and vacancies does not appear to seriously bias the coefficients of the estimated UV relationship (Nickell *et al*, 2002). Moreover, given that the analysis in this paper is at the micro-level, the local area unemployment rate can be reasonably taken as given rather than jointly determined with the level of vacancies at the establishment.

vacancy incidence and the vacancy propensity. Differences in vacancy incidence and vacancy rates by establishment size are particularly notable. However, despite having a large number of explanatory variables, there still remains considerable variance in vacancies that cannot be accounted for by the observable and measurable differences between establishments. This is perhaps unsurprising given that, in aggregate, the stock of vacancies is of the same order of magnitude as the inflow and outflow of vacancies.

Despite the heterogeneity in vacancies, a statistically significant negatively sloped local UV curve can be identified at the establishment level. This relationship is robust, although it is weaker for hard-to-fill and skill-shortage vacancies. This finding accords with our expectations since these are the vacancies that the unemployed are least likely to be qualified for. The negatively sloped UV relationship is strongest and steepest for non-skill shortage vacancies, which comprise the majority of vacancies, and perhaps more closely represent normal labour turnover. One implication of this finding is that even at a time of tight labour markets as in Spring 2001 (or even arguably at full-employment and an excess demand for labour), local labour markets appear to operate in fairly conventional ways as far as the supply of workers and the supply of jobs is concerned.

The remainder of the paper is organised as follows. Section 2 briefly reviews the theoretical and empirical literature on vacancies and the relationship between vacancies and unemployment. Section 3 documents the distribution of vacancies across regions, industry, sector etc before describing the empirical modelling strategy that this distribution suggests. Section 4 discusses the determinants of vacancies and presents the empirical estimates of the joint determination of vacancy incidence and vacancy propensity at the establishment level. Finally section 5 concludes.

2. Some Theory and Previous Evidence on Vacancies and Unemployment

Modern theories of the relationship between unemployment and vacancies are mainly derived from the notion of a matching function. Petrongolo and Pissarides (2001) present a recent and comprehensive survey of the theoretical and empirical

literature. A matching function, M, is a relationship between the number of job matches or hires (denoted M), the number of vacancies currently available (denoted V), the number of unemployed workers looking for jobs (denoted U), and perhaps some other factors (X say), which impact upon the matching process and influence the degree of 'mismatch' between the unemployed and the stock of vacancies. These additional factors may include search intensity, geographic mobility, measures of skills and skill requirements etc. The matching function can thus be written as:

$$M = M(V, U, X),$$

with $M_V > 0$ and $M_U > 0$, so that the greater the number of vacancies, or number of unemployed workers, the higher the expected number of matches/hires in any time period. M is typically specified to be Cobb-Douglas in form and the rate of job matching can therefore be expressed in terms of a log-linear function of the unemployment and vacancy rates. In steady-state equilibrium, the number of matches is equal to the number of job separations (the number of quits plus fires) which is usually assumed to be some constant proportion of employment reflecting an exogenous quit rate. Thus, given X and a fixed job separation rate, this yields an inverse relationship between the vacancy rate and the unemployment rate which is usually termed the Beveridge or UV curve. The X factors then serve to locate the curve in unemployment-vacancy space.

Two empirical estimation strategies have been employed in the literature on matching functions. First, there are a large number of direct estimates of matching functions utilising data on hiring rates, vacancies and unemployment. The empirical evidence from aggregate and disaggregated time-series studies tends to suggest that matching functions exhibit constant returns[7]. Estimates for local labour markets in Britain include Coles and Smith (1996) who estimate using cross-section data across travel-to-work areas (TTWAs) and Bennet and Pinto (1994) who utilise time-series data for the former Training and Enterprise Councils (TECs) areas. Both studies find evidence in favour of a constant returns matching function with a negative relationship between unemployment and vacancies at the local labour market area level.

[7] See, for example, Pissarides (1986), Blanchard and Diamond (1989) and Coles and Smith (1996), and, in particular, the survey of evidence presented by Petrongolo and Pissarides (2001).

Second, in the absence of data on hiring rates, there are also some estimates of the UV relationship assuming steady-state equilibrium in the labour market and thus constant hiring and separation rates. Wall and Zoega (2002) impose the steady-state assumption and constant returns to estimate UV curves for the 10 standard regions and for Britain as a whole. Using time-series and cross-section county-level data, their main interest is in shifts in Beveridge curves, and in particular, whether these are due to structural changes as the theoretical literature presumes[8], or whether they may also shift over the business cycle[9]. In aggregate, they find a statistically significant negative relationship between unemployment and vacancies. However, for the 10 regions separately, six display a positive UV relationship, and only four negative. None are significantly different from zero. In summary, the extant empirical evidence on the relationship between vacancies and local unemployment is not conclusive.

There has been very little previous research which focuses on the determinants of vacancies. In part, this is undoubtedly due to the paucity of data on vacancies and vacancy rates. The matching function literature and estimates of the Beveridge curve typically take the number of vacancies, or the vacancy rate, as given. In this paper, an important objective is to investigate the determinants of vacancies at the establishment level. Previous studies include Haskel and Martin (2001) (UK), Holzer (1994) (US), and Morissette and Zhang (2001) (Canada). The analysis in the following sections is most closely related to that of Holzer (1994) in that the concern here is with both vacancy incidence and vacancy rates. However, in distinguishing between the various types of vacancies (hard-to-fill and skill-shortage vacancies in particular), there are clearly parallels with the recent work of Haskel and Martin (2001) who utilise 1991 Employee Manpower and Skills Practices Survey (EMSPS)

[8] For example, hysteresis-type effects may shift the Beveridge curve due to the adverse effect on the search effectiveness of the unemployed because of long and/or multiple spells of unemployment. These denude their work skills and their attractiveness to employers, which thereby affects the matching rate between the unemployed stock and the vacancies available.

[9] In particular if vacancies adjust more quickly than unemployment or if on-the-job search has a cyclical component, then the matching function (and hence the Beveridge curve) may shift with the cycle. Their main conclusion is that there has indeed been considerable movement in the Beveridge curve over the business cycle in Britain over the last 25 years, which has important implications for the understanding of the persistence of unemployment.

together with the 1990 Workplace Employee Relations Survey (WERS). However, comparisons are difficult because the definitions of hard-to-fill and skill-shortage vacancies are rather different between the EMSPS and the ESS2001 data used in this paper.

3. Data, Definitions and Modelling Strategy

In this paper, the primary dataset used is the 2001 Employers Skill Survey (ESS2001) – see Hogarth *et al* (2001) for further details. This is a telephone survey of approximately 27,000 establishments in England conducted mainly during Spring 2001[10]. The overall response rate from employers was 53%. Variable sampling fractions across regions, industrial sector and establishment size were used and, on the basis of the achieved sample, appropriate weights were subsequently constructed so that the achieved sample can be grossed-up to be representative of the population of just over 2 million establishments in England. The grossed-up distribution of establishments and employment by establishment size bands is presented in Table 1 together with the number of sample observations in each size band. While establishments employing fewer than five workers comprise 72% of all establishments, they only account for around 11% of employment. At the other end of the scale, only 0.14% of establishments employ 500 or more workers, but more than 15% of employment is located in these establishments. As shown in the final column of Table 1, and as in common in establishment surveys, larger establishments were 'over-sampled' relative to their distribution in the population in order to more accurately capture the establishment characteristics of the relatively large proportion of employment that is located in these few establishments.

In the analysis that follows, establishment-weighted and employment-weighted statistics are carefully distinguished. In this paper, primary interest is in the determinants of vacancies at the establishment level and hence establishment-weighted estimates are the main focus. However, in this section, which comprises mainly descriptive analysis, both employment-weighted and establishment-weighted

[10] ESS2001 was commissioned by Department for Education and Skills, designed and coordinated by the Institute for Employment Research (IER), University of Warwick, and conducted on their behalf by IFF Research Ltd.

statistics are presented for comparative purposes. The choice between the two units of analysis – whether establishment-based or employment-based – is important and is related to the issue of weighting. The difference between these two alternatives is perhaps best understood with an example. The average vacancy rate can be measured in two ways. If workers selected at random from the workforce are asked how many vacancies there are at their workplaces, and how many employees, then the ratios of the two will yield the employment-weighted average vacancy rate. However, if only randomly selected establishment managers are asked how many vacancies there are their workplaces and how many employees, then the ratio of these will provide the establishment-weighted average vacancy rate. The difference is that in the first case, larger establishments are more likely to be sampled since they have more employees, whereas in the second case, all establishments have an equal change of being sampled. The choice between the different weighting strategies - employment or establishment - depends on the questions being asked[11]. If the analysis is primarily concerned with documenting how many vacancies there are, then the appropriate weighting is by employment. However, if the analysis is concerned with the circumstances under which vacancies are generated and/or filled (or remain unfilled), then an establishment-based approach is arguably of greater interest since this is the relevant unit of analysis (eg for HRM policies and practices) at which any mismatch between the skills of the applicants and the requirements of the jobs would be identified. The establishment (or firm) is also the level at which at which vacancies are initially identified, notified/advertised and filled, and hence any analysis of the determinants of vacancies is most usefully conducted at the establishment level. In contrast, the employment-level analysis is more useful for describing the aggregate and disaggregate statistics on the distribution of vacancies and the average vacancy rate within the workforce.

[11] Note that this weighting ensures that the ESS2001 sample distribution is the same as the population (England) from which it was drawn despite the quota-based sampling strategy used to compile the ESS2001 (see Hogarth *et al*, 2001 for further details). That is, in both employment-weighted and establishment-weighed reweighting schemes, the resulting estimates will be representative of the population – of the employed and of all establishments respectively – in England as a whole.

3.1 Vacancies and Vacancy Rates: Definitions

The initial task in this paper is to examine the distribution of vacancies of varying types as identified by the respondents in the ESS2001. First, for total vacancies, the question asked in the ESS2001 survey was (question D2):

"How many vacancies, if any, do you currently have at this establishment?"

Note that the question does not distinguish between internal or external vacancies, nor is it prefaced or followed by questions which determine whether these 'vacancies' have actually been advertised (either internally or externally), and/or whether the establishment/firm has actively engaged in any recruiting activity to fill the vacancies. Vacancies are therefore less well-defined in ESS2001 when compared to some other surveys which have been rather more explicit in their definition and identification of vacancies. For example, the recent (1999) Canadian *Workplace and Employee Survey* (WES) - as discussed by Morissette and Zhang (2001) - asked respondents first whether vacancies were usually staffed from *within* or *outside* the workplace, and then whether there were any vacancies "that the workplace was currently trying to fill", and if so, how many. Similarly, the UK's *National Survey of Engagements and Vacancies* (1977) defined a vacancy as a job which "is currently vacant, available immediately and for which the firm has taken some specific recruiting action during the last four weeks" (reported in Jackman *et al*, 1989). The Canadian *Job Vacancy Survey* 1971-78 took a similar definition (although, in contrast, the more recent WES explicitly does not since its responses include vacancies that are only available to applicants from within the workplace/firm). Finally, the new ONS Vacancy Survey (VS) (Machin and Christian, 2002) defines a vacancy as a position which is available to suitable candidates from outside the business or organisation concerned, and for which the employer has taken 'active steps' (such as advertising, notifying a Jobcentre or private employment agency etc) to fill.

Hillage *et al* (2002) document a qualitative investigation of respondents' interpretation of 'vacancies' (and some other terms and definitions) in the 2002 Employers Skill Survey which asked identical questions with regard to vacancies to those in ESS2001. A small number of follow-up interviews were undertaken with survey respondents in an attempt to investigate the validity and reliability of the data series. The evidence from these follow-up interviews is encouraging in that a relatively unambiguous view emerged and, in particular, the interviewees had a fairly clear idea

of what constituted a vacancy[12]. This focus on the definition of a vacancy is important since the economic concept of a vacancy is that of a job which is unfilled and available to external applicants. Clearly, perhaps especially in larger establishments and firms, some vacancies may be effectively reserved for incumbents and thus the ESS2001 may overstate the number of jobs available to unemployed workers. On the other hand, as noted by Ostry and Sunter (1970), requiring employers to be engaged in some recruiting activity may exclude some genuine vacancies since some employers will have stopped looking because of their previous lack of success in trying to recruit – a similar concept to the discouraged worker effect when recording unemployment under the standard ILO definition. Moreover, in multi-establishment firms/organisations, the establishment respondent may be unaware of the recruitment strategies conducted by their 'head-office'. Finally, at the establishment level, the locus of responsibility may be such that while the respondent considers there to be a need for more staff, those ultimately in charge of recruitment may not be similarly inclined. Thus the ESS2001 will record these vacancies while other surveys would fail to do so. These ambiguities in the measurement of vacancies in ESS2001 need to be considered when assessing the conclusions and implications of the analysis presented below. However, clearly the findings presented by Hillage *et al* (2002) lend greater confidence to the interpretation and analysis of the ESS2001 vacancy data.

In order to directly assess and to validate the measures of vacancies analysed in this paper, it is useful to compare the number of vacancies in ESS2001 with the aggregate series previously available from the ES. As noted in the introduction, this latter series has now been discontinued, but the latest figure published for April 2001 coincides roughly with the date that ESS2001 was being completed[13]. At that time, the stock of vacancies notified to Jobcentres for the UK was recorded as 387,800. The ES estimates that approximately one third of all vacancies are notified to Jobcentres, so this yields an estimated 1.16 million vacancies for the UK. Approximately 85% of the UK economically active population is resident in England

[12] Generally, there was a degree of formality attached to it: there was a specific slot to fill, which may have required approval, especially where there was a defined staffing level or establishment. A vacancy referred to a permanent position and involved active recruitment, rather than taking people 'on spec'.

[13] The ESS2001 fieldwork was conducted from November 2000 to April 2001.

according to the LFS. Applying this proportion, the estimated stock of vacancies in Spring 2001 in England is approximately 1 million. The grossed-up estimate for England from ESS2001 is 0.77 million vacancies, which, while of the same order of magnitude, is somewhat lower[14]. This divergence may reflect the particular nature of vacancies typically notified to Jobcentres as noted above, with the implication that grossing-up the ES figures in the manner described above will overestimate the total stock of vacancies in the whole economy.

An explicit comparison of the vacancy statistics in ESS2001 and in the new ONS VS is presented in Machin and Christian (2002). The VS figures refer to the period April to June 2001 and so again are roughly comparable in terms of the timing of the two surveys. Once adjustments for the different regional and sectoral compositions of the two surveys have been made, the total number of vacancies reported in ESS2001 appears to be roughly 40% above the comparable figure from the ONS VS. Machin and Christian (2002) conclude that this is probably mainly due to the lack of a formal definition of a vacancy in ESS2001. However, as they show, the distribution of vacancies by industry in the two surveys is remarkably similar.

Two sub-categories of total vacancies are also separately identified in ESS2001 – namely hard-to-fill vacancies and of these, those that are hard-to-fill because of skill-shortages. Similar problems to those noted above for total vacancies arise with the definition of hard-to-fill vacancies. The relevant question in ESS2001 is (question D6):

"Are any of the vacancies you currently have for (occupation) proving hard-to-fill?"

Again, there is no clear definition provided of 'hard-to-fill' and clearly this is open to interpretation by the respondents[15]. Those vacancies that are not hard-to-fill are

[14] However, a more recent estimate of the proportion of vacancies notified to Jobcentres by Machin and Christian (2002) for May 2002 using the new ONS VS is 44%. Applying this figure to the ES Jobcentre total would yield 0.88 million vacancies for the UK, and hence an estimate of 0.75 million vacancies for England - remarkably close to the 0.77 million vacancies recorded in ESS2001.

[15] However, subsequent to ascertaining how many hard-to-fill vacancies there are for each occupational category, respondents were asked how long the vacancies had lasted. This information could be used to more clearly identify the concept of a hard-to-fill vacancy and to provide consistent and comparable definitions between respondents. Nevertheless, to facilitate comparisons with previous analyses of ESS2001 (especially Green and Owen, 2002), and with the analyses of the previous Employers Skill Survey (ESS1999 – see

denoted non-hard-to-fill vacancies. Finally, skill-shortage vacancies are defined as hard-to-fill vacancies which are skill related in that at least one of the following causes were cited by the respondent (question D12): low number of applicants with required skills; lack of work experience the company demands; lack of qualifications the company demands. The complementary set of vacancies are denoted non-skill-shortage vacancies.

While there are inherent weakness in the data due to the interpretations that individual respondents may have given to the questions regarding vacancies and their nature, an important advantage of the ESS2001 is that the questions were asked of a large number of establishments across spatial and industrial groups and different establishment sizes. Moreover, the ESS2001 sample is representative of all establishments and employment in England at the survey date. Hence, the findings reported below are unlikely to be adversely affected by any particular systematic bias for certain types of establishments to over or under-report the number of 'vacancies' actually available to unemployed individuals, or to utilise systematic differences in their classification of 'hard-to-fill' vacancies etc. Thus we can be reasonably confident in the distribution of vacancies that the data reveal.

The establishment-level vacancy rate is defined as the fraction of unfilled jobs (i.e. vacancies) out of the total number of jobs at the establishment, where the latter is the sum of current employment and vacancies. That is, the vacancy rate, v, is defined as $v = V/(E+V)$ where V is the number of vacancies and E is current employment[16].

Bosworth *et al*, 2000a; 2000b), throughout this paper the simple response to question D6 is used despite the potential differences in interpretation between respondents.

[16] Holzer (1994), Statistics Canada (reported in Morisette and Zhang, 2001, p.2, fn.4) and Morissette and Zhang (2001) all utilise this definition of the vacancy rate: "Vacancy rates are thus defined as the fraction of vacancies out of total jobs in the firm, where the latter is the sum of current employment and vacancies" (Holzer, 1994, p.21); "The vacancy rate - the number of job vacancies divided by the number of jobs (where the latter is the sum of the level of employment and the number of vacancies) …", (Morissette and Zhang, 2001, p.2, fn.4). However, Green and Owen (2002), use vacancy density, defined as V/E, as their measure in order to maintain comparability with previous analyses of the ESS1999 data. Clearly, at the margin, for large establishments, whether vacancy rates or densities are used makes little difference to the calculated vacancy intensity. However, for small establishments (which dominate the population of establishments as seen in Table 1), large differences in the reported vacancy rates are produced if the alternative vacancy density measure is used. For example, suppose that an establishment has four jobs, one of which is currently vacant.

Separate vacancy rates are calculated for all vacancies, and the two complementary paired sub-categories of hard-to-fill and non-hard-to-fill vacancies, and skill-shortage and non-skill-shortage vacancies. Clearly the distribution of these sub-sets of vacancies and their determinants may be rather different from that for vacancies as a whole, and hence these different categories of vacancies are also investigated separately in the following analysis.

3.2 Vacancy Incidence and Vacancy Rates: Descriptive Statistics

3.2.1 Vacancy Incidence

Panel A of Table 2A reports the proportion of establishments in England reporting any vacancies, any hard-to-fill vacancies, any non-hard-to-fill vacancies, any skill-shortage vacancies and any non-skill-shortage vacancies. Panel A of Table 2B reports the same vacancy incidence statistics but expressed as a proportion of total employment in England. Thus Table 2A, column 1 reveals that 14.5% of establishments reported that they had some vacancies, and these establishments comprised 44.2% of employment as shown in Table 2B, column 1 (and thus 44.2% of workers were working in an establishment with at least one vacancy). The remaining columns show that 7.5% of establishments covering 22.1% of all workers had some vacancies that were deemed by the respondents as being hard-to-fill, while 8.3% of establishments covering 32.5% of employment had vacancies which were non-hard-to-fill[17]. Similarly, 3.7% of establishments covering 10.7% of employment had some vacancies which were hard-to-fill because of skill-shortages while 11.9% of establishments employing 39.3% of all workers had some vacancies which were not due to skill-shortages. As noted in Hogarth *et al* (2001), the statistics for hard-to-fill and skill-shortage vacancies are slightly lower than the proportion of establishments reporting such vacancies in ESS1999 once the smaller (less than 5 employees) establishments which were not surveyed in 1999 are excluded. This fall in vacancy incidence has occurred despite the fact that recorded unemployment in England fell between the two survey dates.

Then the vacancy rate as used in this paper is 25%, while using density V/E as the measure yields 33%, a substantial over-estimate of the actual vacancy *rate*.

[17] Note that these do not add to give the total in column 1 since several establishments have both hard-to-fill and non-hard-to-fill vacancies.

In order to assess the regional, sectoral and size composition of vacancy incidence, the remaining four panels of Table 2A and Table 2B report the same measures of vacancy incidence disaggregated by region (Panel B), main business activity (Panel C), broad sector (Panel D) and establishment size (Panel E). The proportion of establishments and of employment with some vacancies is marginally higher in the south and east than in the north and west, with the West Midlands belonging to the former cluster and the East Midlands with the latter. This weak regional pattern is also broadly apparent in the distribution of the four sub-categories of vacancies – the different measures are all positively correlated with each other and with the incidence of any vacancies. This regional disparity would appear to be inversely related to the regional unemployment rate (and non-employment rate), and this consistent with what might be expected from a matching model/Beveridge curve explanation for the relationship between vacancies and unemployment. The exceptions are London and West Midlands which record both relatively high unemployment and non-employment rates and a high propensity for establishments to report vacancies.

There is considerably more variation in the propensity of establishments to report vacancies, and the type of vacancies they report, by business type than by region. Around one quarter of education, health and social work, and public administration establishments report that they have some vacancies, with a consequence that between 50% and 60% of workers in those sectors are working in establishments which are at less than full employment. Outside these public-sector establishments, those in electricity and water supply and finance also have a high propensity to report that they have some vacancies. In contrast, very few establishments in mining and quarrying, agriculture and construction report that they have any vacancies.

The establishments in education and health and social work report that they have vacancies that are particularly hard-to-fill – the probability of having such vacancies is more than twice the national average in education. While there is no further information to help identify these establishments, a strong possibility is that these hard-to-fill vacancies are in schools (and colleges) and hospitals and reflect the widespread and frequent reports of problems in recruiting teachers and nurses. While these represent only a small proportion (2.28 + 4.37 = 6.6%) of all establishments, they comprise a rather larger proportion of employment (7.33 + 10.34 = 17.7%) due

to their size. In the electricity and water supply industry, (0.075/0.215 =) 35% of establishments which report that they have some vacancies record that some of these vacancies are hard-to-fill due to skill shortages. However, this is a very small sector both in terms of the number of establishments and the numbers employed in those establishments. All three of these sectors also report that they have non-hard-to-fill and non-skill-shortage vacancies at well above the average national rates. Clearly, these sectors can be characterised as having recruitment difficulties.

This distribution in responses by business type is reflected in the sectoral propensity to report vacancies as shown in the Panel D Table 2A and Table 2B. Almost one fifth of establishments in the public sector have vacancies of some kind - this is a higher proportion than even in the voluntary sector. Both sectors, but particularly the public sector, would appear to have high turnover and/or recruitment difficulties relative to the private sector – they both tend to have high levels of both hard-to-fill and non-hard-to-fill vacancies, with those in the voluntary sector particularly hard-to-fill, mainly due to skill-shortages amongst the applicants.

The final panel of Tables 2A and 2B decomposes vacancy incidence by establishment size. Here the differences between the categories are considerable, with smaller establishments having significantly lower incidence rates by establishment and by employment as would expected. This is due at least in part to the indivisibility of a 'vacancy'[18]. The incident rates for all categories of vacancies increase monotonically with establishment size. However, the *relative* increase in the incidence of hard-to-fill and skill-shortage vacancies is rather less than their complements of non-hard-to-fill and non-skill shortage vacancies respectively.

3.2.2 Vacancy Rates

Tables 3A and 3B reports vacancy rates measured as a proportion of jobs in the establishment as discussed above by establishment and by employment respectively. Once again, the aggregate statistics are supplemented by a decomposition by vacancy types and by region, business type, sector and establishment size as above. Panel A records that the average establishment has a

[18] That is, in a two-person establishment, the vacancy rate needs to be 50% before there is a vacancy available, whereas in a 100-person establishment, it only needs to be 1%.

vacancy rate of 4.2%, half of which are hard-to-fill vacancies, and just under half of these are due to skill-shortages[19]. Thus, on average, approximately three-quarters of vacancies at an establishment are not vacant due to skill deficiencies amongst the applicants, but perhaps reflect underlying turnover and adjustment in the workforce. In terms of aggregate employment however, the vacancy rate is rather lower at 2.7%. This therefore implies lower vacancy rates at larger establishments in general. Over 80% of all vacancies are not related to skill-shortages.

As shown in Panel B of Tables 3A and 3B, average establishment-level vacancy rates range from 2.3% in Yorkshire and Humberside to 5.7% in London, although as a proportion of total employment, the range is rather narrower. Finance and business service establishments have relatively high average vacancy rates, while primary sector industries (agriculture, mining, electricity and water) have relatively low average vacancy rates (Panel C of Table 3A). In terms of employment, however, it is the hotels and restaurants sector which posts the highest vacancy rate: 4.1% of jobs in that sector were unfilled at the time of the survey, most of which are unskilled (Panel C of Table 3B). This may be a reflection of the high turnover rates experienced in this industry. Establishments in the voluntary sector have the highest average vacancy rates and the proportion of vacant positions at 4.1% was almost double that of the public sector (Panel D of Tables 3A and 3B). Finally, as can be seen in Panel E of Tables 3A and 3B, aggregate vacancy rates fall with increasing establishment size as would be expected. However, there are differences between the subcategories of vacancies; non-hard-to-fill and non-skill-shortage vacancy rates are fairly constant (above the smallest size category), and the fall in aggregate vacancy rates are thus driven by lower hard-to-fill and skill-shortage vacancy rates for larger establishment. This may reflect the more extensive recruitment activities in larger firms, as well as their ability to train existing staff and to move incumbents to meet skills needs as they arise within their organisations. Smaller establishments are at a clear disadvantage in all these respects.

There are clear and important differences in the propensity for establishments to report that they have some vacancies and the vacancy rates they report. This is

[19] Here, of course, the statistics do sum across the columns, since the two paired categories are mutually exclusive.

perhaps most clearly evident when we compare Panel D of Tables 2A and 2B and Tables 3A and 3B. While the public sector has the highest proportion of establishments with some vacancies (19.7%), and the highest proportion of workers employed in establishments with some vacant positions (54.0%), it also has the lowest average establishment-level vacancy rate (3.4%) and the lowest proportion of unfilled jobs (2.2%). These differences are clearly most obviously related to establishment size differences between sectors, but other factors are likely to be important too as evidenced by the dissimilarities in the rankings of vacancy propensities and vacancy rates between regions and business types. These distinctions between vacancy propensities and vacancy rates in part determine the modelling strategy utilised in the next section.

Further descriptive evidence on the distribution of the number of vacancies and vacancy rates by establishment size is presented in Table 4. Vacancy frequencies by establishment size, as well as the proportion of establishments reporting some vacancies, the conditional mean number of vacancies and the vacancy rate for establishments with some vacancies, and the mean vacancy rate across all firms in each size category are reported. Table 4 reveals several important features. First, most establishments, and the majority in every size category with less than 100 employees (which account for more than 98% of all establishments – see Table 1) report no vacancies of any kind. This is illustrated clearly in Figure 2. Where vacancies exist, they are few in number – typically just one or two jobs are available, if any. The proportion of establishments with at least one vacancy increases with establishment size, as does the conditional mean number of vacancies. However, the number of vacancies available increases less rapidly than firm size with the consequence that the conditional mean vacancy rate *falls* monotonically with firm size. Thus in the smallest size category (1-4 workers), the average vacancy rate for establishments with at least one vacancy is 48.8%, while for the largest size category (500 or more workers), the average vacancy rate is only 2.9%. Even the unconditional vacancy rate shown in the final row of Table 4 falls fairly consistently with firm size.

These patterns in the probability of establishments having any vacancies, and in the conditional vacancy rate are replicated *a fortiori* for hard-to-fill vacancies (illustrated

in Figure 3) and for skill-shortage vacancies (illustrated in Figure 4)[20]. The most obvious explanation lies in the indivisibility of individual jobs coupled with the low proportions of establishments with any vacancies. The larger the establishment, the more likely it is that there is at least one vacant position, but when vacancies do occur at smaller establishments, they will account for a larger fraction of the jobs than in larger establishments. However, as noted by Holzer (1994), other factors are also likely to be important. For example, larger establishments are more likely to have HR departments and hence able to more clearly identify the existence of vacancies.

Finally, in order to more comprehensively illustrate its variation, the total variance in the vacancy rate is decomposed into the between- and within- sub-category proportions by region, business type, sector, establishment size and LLSC area. That is, the variance in the vacancy rate across all establishments is calculated, and then the extent to which this variance is a result of variation in establishments' vacancy rates *within* regions, or *between* regions (or business types, sectors etc) is computed. Because the variance can be decomposed exactly into its between and within contributions (see, for example, Cowell, 1995), then the proportions of the total variation in the vacancy rates which is due to variation in the vacancy rate within regions and due to the variation in the vacancy rate between regions (or business types, sectors etc) can be calculated. This decomposition is presented for the overall vacancy rate, for all establishments (unconditional vacancy rates - Table 5A), and also for just those establishments with positive vacancy rates (conditional vacancy rates - Table 5B).

A number of features of the variation in vacancy rates are revealed by this decomposition. First, when measured across all establishments, almost all of the variation in the vacancy rate is within- rather than between- sub-categories. This implies that there is much more vacation in the vacancy rates between establishments within any region (business type, sector etc), than there is between in the vacancy rates between regions (business type, sector etc). This is perhaps unsurprising, but the scale of the magnitude is notable. More than 99% of the variation in the unconditional overall vacancy rates between establishments are

[20] These results are available on request.

differences within regions, and less than 1% of the variation is between regions[21]. One consequence of this finding is that differences between regions (or regional effects) would be expected to account for very little of the variation in the vacancy rate if all establishments are considered together. In part, this finding is a result of such a large proportion of establishments having a vacancy rate of zero irrespective of region.

When attention is restricted to those establishments with some vacancies (Table 5B), a rather different picture is apparent. First, and as previously noted in the discussion surrounding Table 4, conditional vacancy rates differ considerably between establishment size groups: over two-thirds of the variance in vacancy rates is between establishment size groups, and less than one-third is within size groups. That is, there is considerably more variation in vacancy rates between size groups than there is within size groups. However for all other sub-categories, the within-category component still dominates the between-category component. One slight exception is that, while there is still little variation in vacancy rates between regions, there is a reasonable proportion between LLSC areas suggesting that the regional dimension disguises differences in vacancy rates that exist at the sub-regional level.

3.3 Modelling Strategy

Given that the vacancy rate can only be non-negative, together with the fact that most establishments have zero vacancies implies that the estimation procedure cannot be of the simple linear regression variety. The appropriate specification which takes account of the clustering of a large proportion of observations at zero, together with only positive values at the non-zero observations is the Tobit model. However, the findings reported in Table 4 indicate that the influence of firm size on the probability of an establishment having non-zero vacancies (vacancy incidence) is positive, while its influence on the (conditional and unconditional) mean vacancy rate (vacancy propensity) is negative, and this cannot be accommodated by the simple Tobit specification which restricts the influence of any variable on both the probability of a non-zero observation, and on its magnitude if non-zero, to be the *same* sign. Clearly, there may be other variables which potentially have differential influences on

[21] A similar conclusion holds for the sub-categories of hard-to-fill, non-hard-to-fill, skill-shortage and non-skill-shortage vacancies (results available on request).

the vacancy incidence and the conditional vacancy rate. In effect, two sets of coefficients are required for each independent variable in any model of the determinants of vacancies while the simple Tobit only yields a single effect.

An appropriate specification which does allow for the kinds of differential effects seen for firm size is the modification of the Tobit model suggested by Cragg (1971)[22]. This is a two equation model, defined as:

$$P(v_i > 0) = \Phi(X_i\beta_1) \quad (1)$$

$$E(v_i \mid v_i > 0) = X_i\beta_2 . \quad (2)$$

where Φ is the CDF (cumulative density function, or distribution function) of the standard normal distribution. The first equation represents the probability of an establishment i having positive vacancies (or a positive vacancy rate since V > 0 and v > 0 are clearly synonymous). Given the nature of the dependent variable (either 1 (=yes or 0 (=no)), we estimate this using a probit model. The second equation specifies a model for the conditional vacancy rate (i.e. conditional on having some vacancies, v > 0), and this is estimated using a truncated regression model given that only positive observations on v are observed. If $\beta_1 = \beta_2$, then the model becomes the simple Tobit model. As seen above, given the differential impact of establishment size on the vacancy incidence (i.e. probability of having any vacancies) and on the vacancy propensity (i.e. vacancy rate), this restriction is not expected to hold. However, this restriction is formally tested in the analysis that follows[23].

Since the primary interest is in the relative importance of the determinants of vacancy incidence and vacancy propensity, the marginal or partial effects for the regressors are reported. For the probit specification, these are the magnitude of the impact of the regressor on the probability of an establishment reporting any vacancies. For

[22] The classical example in the literature, due to Lin and Schmidt (1984), is the 'loss due to fire' as a function of the 'age of the building'. Newer buildings typically have a lower probability of having fires, but have a greater average loss when a fire does occur.

[23] An alternative approach would be to estimate the two equations jointly so that the relationship between their error terms is explicitly modelled rather than ignored as here (see Greene, 2000). The resulting specification would be formally equivalent to the standard Heckman (1976) selection model or a Type-II Tobit model in the Amemiya (1985) classification system. One cost would be the identification restriction required (i.e. specifying variable(s) which determine the vacancy incidence but not the vacancy rate) and none is immediately obvious. However, consideration of this alternative econometric specification is an area for future investigation.

binary/dummy variables, since there cannot be a marginal change in, say, being in the private sector, the change in the probability of having any vacancies for the discrete change in the dummy variable from 0 to 1 is therefore calculated. In the truncated regression, the marginal effects represent the impact on the log vacancy rate and thus record the proportionate impact on the vacancy rate for a unit change in the independent variable[24].

Finally, in order to measure the overall impact of any particular variable X on the vacancy rate, its impact on vacancy incidence and vacancy propensity need to be combined. Differentiation yields:

$$\frac{\partial v}{\partial X} = \frac{\partial(P(v > 0) \times E(v \mid v > 0))}{\partial X} = \beta_1 \phi(X_1 \beta_1) \times E(v \mid v > 0) + \beta_2 \times P(v > 0) \qquad (3)$$

where ϕ is the standard normal density function. These overall marginal effects are also reported in the results in the following section.

4. The Determinants of Vacancies

There are potentially a large number of variables that may contribute to differences in the probability that an establishment has vacancies (i.e. vacancy incidence), and to differences in the vacancy rate at the establishment if there are some vacancies (i.e. vacancy propensity as measured by the conditional vacancy rate). However, no attempt is made to hypothesise which factors may influence only the vacancy incidence from those that may determine the vacancy propensity. Rather, a common vector of variables is specified for both the probit and the truncated regression part of the model. Given that in steady state, the vacancy rate is identically equal to the product of the vacancy inflow rate and the average vacancy duration, factors which affect either the number of vacancies or the duration of vacancies (or both) will impact on the measured vacancy rate. A brief description and summary statistics for the variables used in the empirical analysis is presented in Table A1.

[24] The dependent variable in the truncated regression equation (2) is defined as log(1+v) in the empirical estimates presented below. This transformation reduces the skewness in the distribution of positive vacancy rates and ensures the continuity of the underlying latent variable (vacancy propensity) at v = 0.

4.1 Establishment and Firm Characteristics

The first specification (specification A) simply includes a number of controls for firm and establishment characteristics. The first group of variables control for differences in establishment size. Rather than impose linearity or any other functional form on the relationship between size and vacancy incidence and vacancy propensity, eight grouped measures of establishment size (denoted *esize1* to *esize8* and defined as previously) are included, with *esize1* (1-4 employees) as the omitted (base) category. Given the figures presented in Table 4, the expectation is that vacancy incidence will increase and conditional vacancy rates will decrease with increasing establishment size.

Secondly, a measure of the private/public status of the establishment is included. Clearly, rather different processes (e.g. regarding planning horizons, financial arrangements and constraints) may determine hiring and firing in the public and private sector, and thus a dummy variable denoting private sector establishments (*private*) will reveal what hiring and firing strategies have on vacancies - perhaps because of differences in vacancy durations between public and private sectors. Thirdly, a dummy variable is included for whether the firm is wholly or party foreign owned (*foreign*). While this represents a relatively small proportion of establishments in the population, it seems plausible that recruitment strategies may well differ for such firms.

Fourth, the variable *single* controls for whether the firm is a single or multiple establishment organisation. In multi-establishment organisations, while there may be a greater probability of having formal HR management arrangements which may facilitate recruitment, there may be greater coordination problems with constituent establishments regarding hiring and firing decisions. On similar grounds, a variable controlling for whether the establishment is the head office of the organisation is included (*head office*). Such establishments may have recruitment issues partly or largely unrelated to the operational side of the enterprise, and thus may demonstrate rather different patterns in vacancies.

To capture any expansionary or contractionary effects of the organisation on recruitment and replacement of unfilled positions, the variables *increase* and

decrease control for whether total sales (for private sector enterprises) or budget (for non-private sector establishments) has increased or decreased 'a great deal' in the past 12 months. Related to this are the controls for the establishments' underlying hiring and quit rates (*hire rate* and *quit rate*). These are measured as a proportion of the current workforce at the establishment who have been taken on or left in the preceding 12 months respectively[25].

Finally, measures of the amount of off-the-job training taking place at the establishment are included. Clearly, one response to vacancies, especially those which are hard-to-fill, and/or are the result of skills shortages, is for establishments to train their current workforce to fill these tasks. Their incumbent employees have the advantage of enterprise-specific knowledge which may make them good candidates to fill vacant positions. At the same time, establishments will engage in off-the-job-training for a wide variety of other purposes, including general upskilling of the workforce to meet increasing technical demands, for staff morale, etc. Three dummy variables for different proportions of staff which have engaged in off-the-job-training in the last 12 months are included: 1-20% (*train1*), 20-80% (*train2*), and 80-100% (*train3*), with the base of no employees having received any off-the-job-training in the last 12 months.

4.2 Industry and Area Characteristics

The second and third specifications (B and C) include a number of industry and area characteristics that are likely to impinge on the propensity of establishments to have vacancies, and on their vacancy rates. These are in addition to the firm and establishment level characteristics described above. The first measure of industrial structure included captures the potential supply of labour to the establishment in the local area. This is measured as the proportion of the local labour force (at the LLSC level) which is currently employed in the industry in which the establishment is engaged (*industry empl.*). Clearly, the greater is the local supply of labour with the appropriate skills, the easier it should be for establishments to fill their current vacancies, although they will be competing against a greater number of other

[25] There are a few implausible extreme observations on these variables (questions B7a and B7b) given the size of the incumbent workforce, and hence these observations are discarded in the empirical estimates.

establishments for the same workers and hence the *demand* for these workers is also likely to be greater. The net balance of these two opposing effects is an empirical manner. The share of employment in the local area is obviously only one of a number of industry characteristics that may be relevant to the vacancy process. In particular, in growing or declining industries, there may be additional recruitment issues over and above those at the establishment or local level captured by the other variables included in the specification. Thus, the impact of also including a set of 14 industry dummies is investigated in specification C.

In addition to the industrial composition of the current local labour force, the proportionate rate of growth of the locally employed labour force (at the LLSC level) over the last two years is included (*empl. growth*). High rates of growth in employment may mean a relative shortage of excess labour to fill any vacancies. However, it may also signal to workers currently located outside the local area that it has good employment prospects, and hence they may be more tempted to migrate to the area. The net balance of these two effects is thus uncertain *a priori*. Two measures of the skills of the local labour force are also included. *Low skills* is the proportion of the LLSC labour force which has no qualifications, while *high skills* is the proportion which has NVQ level 4 or above.

The next variable capturing the characteristics of the local labour force and their likely impact on vacancies is a measure of local relative wages (*rel. wage*). This is computed from the (1-digit SOC90) relative wages in the LLSC area (relative to the average for England). A weighted average of these relative wages is computed, with weights given by the shares of each of the 1-digit occupations in the local labour force. Thus rather than simply taking the average wage for all workers in the local area, this measure captures the extent to which the area has high or low wages relative to its occupational composition. This is important the greater is the heterogeneity in the occupational distribution of employment at the LLSC level. Of course, wages may be expected to be endogenously determined with vacancies (effectively an indicator of excess labour demand) and we consider this potential problem further below.

The final variables controlling for the local labour market conditions are two measures of New Deal (ND) activity at the LLSC level. The level of participation in ND activities (*ND_partic.*) is computed as the number of ND participants in the LLSC area expressed as a fraction of total unemployment as at December 2000. The efficacy of the ND activities is captured by the number of unsubsidised jobs gained as a proportion of ND participants at the LLSC level (*ND_efficacy*). Clearly, the greater the participation in ND activities, and the greater the effectiveness of these activities, the lower should be the rate of unemployment for any given level of vacancies. Hence these two variables should act to shift the UV curve inwards towards the origin. However, to the extent that participation in ND activities may be a signal of poor quality in the stock of the unemployed, there may be more vacancies unfilled where ND participation is higher.

The final variable is a measure of unemployment. In the results presented in detail in Table 6, the unemployment measure selected is the LLSC ILO unemployment rate for all those aged 16 or over (*ilo_rate*). However, a summary of the results for alternative measures of unemployment and of surplus labour in the area is also presented in Table 7.

4.3 Results for Vacancy Incidence and Vacancy Rates

The basic results are presented in Table 6. Three empirical specifications (labelled A, B and C as discussed above) of the model in equations (1) and (2) are presented. First, there are the estimates of the probit equation (1) for the presence of any vacancies (Vacancy Incidence). This is followed by the truncated regression results for equation (2) (Vacancy Propensity) for the vacancy rates conditional on there being some vacancies. In both cases, the marginal effects are reported. Finally, the joint marginal effects for changes in the independent variable on the vacancy rate across all establishments are reported as explained in the discussion surrounding equation (3). The restriction to the simple Tobit specification discussed in section 3.3 above is rejected in favour of the two equation model as formulated by Cragg (1971) for all of the three specifications.

Table 6 reveals a number of interesting patterns and findings. First, as had already been anticipated from the cross-tabulations in Table 4, the incidence of vacancies

increases but the vacancy rate decreases with increasing establishment size. The net impact of increasing size on the overall vacancy rate is positive as can be seen in the final columns of the table which report the net marginal effects. The magnitudes of the marginal effects are quite large. For example, for specification C, the impact of an establishment growing from being of average size (10 employees in the sample and thus in *esize3*) to being one standard deviation above the average size (which would place it in size category *esize5*) would be to increase the expected vacancy rate by (0.0480 - 0.0091 =) 0.0389. Given that the average vacancy rate is 0.0423, this represents an increase of over 90% from the mean, or almost 30% of a standard deviation in the vacancy rate.

In contrast, the net impact on the vacancy rate of establishments being in the private sector, foreign or joint foreign/UK owned, or single establishment organisations are negligible. However, establishments which have increased their scale of operation in the last 12 months have vacancy rates over (0.0237/0.0423) 56% higher than establishments which have seen little or no change in turnover or budget. Establishments that are contracting have slightly lower vacancy rates.

Where hiring rates and quitting rates are higher, vacancies are more prevalent as is expected. To gauge the magnitude of the impact of differences in these continuous variables, it is helpful to consider a representative change in the variable. Thus if an establishment has a hiring rate one standard deviation above the mean hiring rate, the impact on the expected vacancy rate will be (0.7082$\times$0.0116=) 0.008 which is small compared to the standard deviation of the vacancy rate (0.1347). Thus while these variables have their expected signs, their impact on actual vacancy rates would appear to be negligible.

Establishments which engage in more off-the-job-training of their workers have higher vacancy rates. There are a number of plausible explanations for this finding. The organisation may be engaged in activities which are increasingly technologically advanced and therefore need to recruit more staff with these skills as well as upgrading the skills of the incumbent workers. Alternatively, anticipating future demands and scale may induce firms to train their existing workers as well as attempting to recruit more workers. In any event, those establishments engaged in

the most training (80-100% of employees receiving off-the-job-training in the previous 12 months) do not appear to be satisfying their requirements for more workers purely from within their own organisation since these have significantly higher vacancy rates.

Turning to the industry and area characteristics, it can be seen that establishments located in areas of low skills amongst the labour force tend to have significantly more vacancies, *ceteris paribus*. However, the size of this effect is again very small. A one standard deviation increase in the proportion of the working age population with no qualifications would increase the expected vacancy rate by ($0.0377 \times 0.1561 =$) 0.006, which is negligible compared to the variation in the vacancy rate. Similarly, while areas of strong employment growth tend to have more vacancies, consistent with the pro-cyclicality of vacancies at the aggregate level, the magnitude of the effect is small.

Higher local relative wages are associated with both higher vacancy incidence and higher vacancy propensity, contrary to expectations. One possible explanation is that local wages are also capturing local costs, and this may mean that recruitment is more difficult. There is also a potential endogeneity issue here. However, given that *rel. wage* is computed as a locally weighted average of occupation-specific relative wages, with wages taken from the NES, individual establishments and firms are effectively price takers for the relative wage they face in their local labour market. Moreover, the results presented are almost invariant to the exclusion of this variable from the specification.

Where there are a large number of ND participants as a share of unemployment, vacancy incidence and vacancy rates are significantly higher. This may be a reflection of the characteristics of the stock of unemployed which will be of longer durations the higher the proportion of New Deal participation, and thus may suffer disproportionately from scarring effects.

Finally, the coefficient on the (log) ILO unemployment rate is negative and significant for both the incidence of vacancies and for the vacancy rate. Its net impact on the overall vacancy rate is thus definitely negative, consistent with the UV or matching

models of the relationship between vacancies and unemployment. However, once again, for reasonable/typical values of differences in the unemployment rate between LLSCs, differences in the expected vacancy rate are fractional[26].

The analysis in Table 6 was repeated for hard-to-fill, non-hard-to-fill, skill-shortage and non-skill-shortage vacancies (results available on request). Notable differences from the results in Table 6 include the finding that areas which have experienced recent employment growth tend to have a lower hard-to-fill vacancy rate and skill-shortage vacancy rates, despite having higher non-hard-to-fill, and non-skill-shortage vacancy rates. It could be argued that these establishments seem to benefit from an expanding local labour force providing suitable workers for hard-to-fill and skill-shortage vacancies, even though overall vacancy rates are higher, perhaps reflecting greater job turnover in these areas and continued expansion.

In order to investigate the robustness of this finding of a downward sloping UV curve at the LLSC level, Table 7 presents a summary of the estimates obtained for different measures of the 'unemployment' rate and also for the different sub-categories of vacancies. For comparative purposes, the first row of the table reports the results obtained for each of the five categories of vacancies for the ILO LLSC unemployment rate (*ilo_rate*) as used in Table 6. The other measures of local (LLSC) unemployment are: the claimant count rate (*urate*); the long-term unemployment rate (claimants who have been unemployed in excess of 6 months - *lturate*); and the non-employment rate (*nonempr*).

The first row of Table 7 reveals that with the exception of the hard-to-fill vacancy rate, the incidence and propensity of all four subcategories of vacancies are significantly negatively related to the local ILO unemployment rate, although the effect is stronger for the non-hard-to-fill and non-skill-shortage vacancy incidence than for their complements. This accords with our expectations since hard-to-fill and, especially,

[26] Given that the local labour market characteristics are defined at the LLSC level, the standard errors should be adjusted to take into account the correlation between the observations at this level (Moulton, 1986). None of the substantive conclusions are affected by this adjustment – in particular, the impact of local unemployment on the vacancy rate is still negative and significant despite the approximate doubling of its standard error.

skill-shortage vacancies are precisely those job openings which have specific requirements that are less likely to be filled from the general stock of unemployment. However, as for aggregate vacancies, the marginal effects on the vacancy rate are rather small.

The remaining rows of Table 7 present the coefficients on the log unemployment variable for the three alternative measures of the unemployment rate. For all four 'unemployment' measures, both the incidence and propensity of total vacancies at the establishment level are negatively and significantly related to the LLSC unemployment rate. For hard-to-fill and non-hard-to-fill vacancies, the incidence of vacancies is consistently significantly related to all four of the unemployment measures. However, for the vacancy rates, the results are less robust. For skill-shortage vacancies, the coefficients on the unemployment measures are mainly negative, but only half are significantly so. Finally, for non-skill-shortage vacancies, vacancy incidence is strongly negatively related to whatever measure of unemployment is utilised, while the conditional rate is also significantly negatively related to the unemployment measures, although the effects are less robust. However, in general, it is clear that there exists a negatively sloped local UV curve at the establishment level.

5. Conclusions

In contrast to the considerable microeconomic and macroeconomic literature on unemployment, surprisingly little is known regarding job vacancies. This paper uses data from a representative survey in Spring 2001 of over 27,000 establishments in England to investigate the distribution and determinants of job vacancies, with a particular focus on the impact of local labour market conditions. At the time of the survey, 14.5% of establishments had at least one vacancy, with 2.7% of jobs unfilled. The survey enables general vacancies to be distinguished from those that are hard-to-fill and also those that are unfilled due to skill-shortages amongst the applicants. Approximately 4% of establishments had at least one skill-shortage vacancy, and around 20% of the jobs which were unfilled remained so due to skill-shortages.

The empirical specification reveals that firm, establishment, industrial and local labour market characteristics are all systematically related to the vacancy incidence and the vacancy propensity. Differences in vacancy incidence and vacancy rates by establishment size are particularly notable. However, there is considerable variation in the distribution of vacancies, and while a number of firm and establishment characteristics can be identified which are significantly associated with higher levels of vacancies, much of the variation in vacancies remains unexplained. One interpretation is that this is due to unobserved heterogeneity between establishments. However, a more satisfactory explanation lies in the fact that aggregate vacancy inflows and outflows are so large relative to the vacancy stock - that is, there is considerable job turnover in the labour market - and this is reflected in vacancies at the establishment level. Thus, while it is possible to identify factors which are correlated with both vacancy incidence and vacancy rates at the establishment, in general there is considerable variation in the vacancy stock between establishments which cannot be accounted for. This interpretation is consistent with the variance decomposition which suggested that most of the variation in both unconditional and conditional vacancy rates was within rather than between the categories examined. The conclusions for the establishment-level analysis are similar. Even controlling for a large number of potential factors which can plausibly affect the vacancy rate, vacancy rates are still quite dissimilar between otherwise similar establishments. The factors which are identified as important can only account for a small proportion of the variation in vacancy rates between establishments at any point in time.

Despite the wide variance in vacancy rates, a statistically significant negatively sloped local UV curve can be identified at the establishment level. This relationship exists for total vacancies, and also for the differing sub-sets of vacancies in general, although it is weaker for hard-to-fill and skill-shortage vacancies in particular. This finding accords with expectations since these are the vacancies that the unemployed are least likely to be qualified for. The negatively sloped UV relationship is strongest and steepest for non-skill shortage vacancies, which comprise the majority of vacancies as noted above and perhaps most closely accord with (frictional) labour turnover. Local labour markets thus seem to work in this sense, even in a period of (close to) full-employment.

REFERENCES

Amemiya T (1986), *Advanced Econometrics*, Basil Blackwell: Oxford.

Bennet R and Pinto R (1994), "The Hiring Function in Local Labour Markets in Britain", *Environment and Planning*, 26, pp.1957-1974.

Birtwhistle A (2001), "Jobcentre Vacancy Statistics", *Labour Market Trends*, March, pp.159-162.

Blanchard O J and Diamond P (1989), "The Beveridge Curve", *Brookings Papers on Economic Activity*, 1, pp.1-60.

Bosworth D, Davies R, Hogarth T, Wilson R and Shury J (2000a), *Employers Skill Survey: Statistical Report*, DfEE/Skills Task Force, SKT 31.

Bosworth D, Wilson R and Davies R (2000b), *Employers Skill Survey: Econometric Report*, DfEE.

Coles M G and Smith E (1996), "Cross-section Estimation of the Matching Function: Evidence from England and Wales", *Economica*, 63, pp.589-597.

Cowell F A (1995), *Measuring Inequality 2nd edition*, Prentice Hall/Harvester Wheatsheaf

Cragg J (1971), "Some Statistical Models for Limited Dependent Variables with Application to the Demand for Durable Goods", *Econometrica*, 39, pp.829-844.

Green A and Owen D (2002), *Exploratory Data Analysis at Local Area Level*, Skills, Local Areas and Unemployment: ESS2001 – Final Report, Institute for Employment Research, University of Warwick, August.

Greene W (2000), *Econometric Analysis 4th edition*, Upper Saddle River, NJ: Prentice-Hall.

Haskel J and Martin C (2001), "Technology, Wages and Skill Shortages: Evidence from UK Micro Data", *Oxford Economic Papers*, 53, pp.642-658.

Heckman J (1976), "The Common Structure of Statistical Models of Truncation, Sample Selection, and Limited Dependent Variables and a Simple Estimator for Such Models" *Annals of Economic and Social Measurement*, 5, pp.475-492.

Hillage J, Regan J, Dickson J, McLoughlin K (2002), *Employers Skill Survey 2002*, DfES Research Report RR372, September 2002.

Hogarth T, Shury J, Vivian D and Wilson R (2001), *Employers Skill Survey 2001: Statistical Report*, IFF Research/Institute of Employment Research.

Holzer H J (1994), "Job Vacancy Rates in the Firm: An Empirical Analysis", *Economica*, 61, pp.17-36.

Jackman R, Layard, R and Pissarides C (1989), "On Vacancies", *Oxford Bulletin of Economics and Statistics*, 51, pp.377-394.

Lin T F and Schmidt P (1984), "A Test of the Tobit Specification against an Alternative Suggested by Cragg", *Review of Economics and Statistics*, 66, pp.174-177.

Machin A and Christian V (2002), "A New Survey of Job Vacancies: The First Experimental Results", *Labour Market Trends*, October, pp.535-548.

Morissette R and Zhang X (2001), "Which Firms have High Job Vacancy Rates in Canada?", Statistics Canada, DP 176, October.

Moulton B R (1986), "Random Group Effects and the Precision of Regression Estimates", *Journal of Econometrics*, 32, pp.385-397.

Nickell S, Nonziata W, Ochel W and Quintini G (2002), "The Beveridge Curve, Unemployment and Wages in the OECD from the 1960s to the 1990s", CEP, LSE, DP 502, July.

Ostry S and Sunter A (1970), "Definitional and Design Aspects of the Canadian Job Vacancy Survey", *Journal of the American Statistical Association*, 65, pp.1059-1070.

Petrongolo B and Pissarides C A (2001), "Looking into the Black Box: A Survey of the Matching Function", *Journal of Economic Perspectives*, XXXIX, pp.390-431.

Pissarides C A (1986), "Unemployment and Vacancies in Britain", *Economic Policy*, 3, pp.499-559.

Wall H J and Zoega G (2002), "The British Beveridge Curve: A Tale of Ten Regions", *Oxford Bulletin of Economics and Statistics* , 64, pp.257-276.

Table 1

Population Distribution of Establishments and Employment

establishment size	Establishments		Employment		Sample	
	number	percent	number	percent	observations	percent
1-4	1,481,191	71.95	2,233,845	10.85	3,701	13.69
5-9	227,664	11.06	1,473,334	7.16	3,676	13.60
10-24	203,044	9.86	3,105,347	15.09	5,090	18.83
25-49	75,978	3.69	2,577,550	12.52	6,151	22.76
50-99	41,507	2.02	2,714,846	13.19	3,306	12.23
100-199	15,493	0.75	2,064,570	10.03	2,605	9.64
200-499	10,928	0.53	3,223,543	15.66	1,799	6.66
500+	2,909	0.14	3,191,056	15.50	703	2.60
Total	2,058,714	100.00	20,584,090	100.00	27,031	100.00

Source: ESS2001.

Table 2A

Vacancy Incidence: Proportion Reporting Vacancies by Establishment

	Vacancy Incidence by Establishment					
	any vacancies	any h2f vacancies	any nh2f vacancies	any ss vacancies	any nss vacancies	%
Panel A: Aggregate						
Total	0.145	0.075	0.083	0.037	0.119	100.00
Panel B: by Region						
Eastern	0.173	0.082	0.102	0.048	0.131	11.35
East Midlands	0.133	0.048	0.093	0.022	0.116	7.85
London	0.159	0.082	0.100	0.044	0.143	18.56
North-East	0.121	0.061	0.069	0.031	0.096	3.50
North-West	0.120	0.066	0.063	0.036	0.091	11.95
South-East	0.152	0.090	0.080	0.038	0.127	17.81
South-West	0.150	0.078	0.080	0.042	0.113	10.50
West Midlands	0.159	0.089	0.079	0.034	0.130	9.75
Yorks & Humberside	0.101	0.044	0.065	0.022	0.085	8.72
Total	0.145	0.075	0.083	0.037	0.119	100.00
Panel C: by Industry						
1.agriculture	0.070	0.050	0.024	0.013	0.058	2.97
2. mining & quarrying	0.027	0.019	0.020	0.002	0.025	0.16
3. manufacturing	0.144	0.068	0.091	0.039	0.117	8.85
4. elect'y & water supply	0.215	0.090	0.147	0.075	0.162	0.09
5. construction	0.090	0.056	0.038	0.036	0.057	9.16
6. wholesale, retail	0.137	0.060	0.082	0.025	0.115	23.32
7. hotels and restaurants	0.155	0.084	0.085	0.030	0.132	7.00
8. transport & comm..	0.163	0.082	0.094	0.040	0.127	4.45
9. finance	0.211	0.081	0.139	0.038	0.179	2.13
10. business services	0.146	0.083	0.086	0.053	0.121	25.06
11. public administration	0.228	0.080	0.192	0.041	0.210	1.00
12. education	0.265	0.152	0.151	0.048	0.233	2.28
13. health & social work	0.250	0.130	0.143	0.045	0.216	4.37
14. other community	0.126	0.068	0.063	0.030	0.100	9.18
Total	0.145	0.075	0.083	0.037	0.119	100.00
Panel D: by Sector						
Private sector	0.139	0.073	0.076	0.036	0.112	85.70
Public sector	0.197	0.084	0.131	0.032	0.173	8.85
Voluntary sector	0.167	0.091	0.133	0.064	0.154	4.72
Total	0.145	0.075	0.083	0.037	0.119	100.00
Panel E: by Est. Size						
1-4	0.097	0.052	0.052	0.029	0.077	71.95
5-9	0.163	0.084	0.088	0.035	0.134	11.06
10-24	0.264	0.137	0.147	0.059	0.216	9.86
25-49	0.361	0.173	0.233	0.073	0.313	3.69
50-99	0.478	0.242	0.310	0.108	0.413	2.02
100-199	0.554	0.252	0.414	0.117	0.498	0.75
200-499	0.636	0.274	0.523	0.133	0.590	0.53
500+	0.705	0.350	0.592	0.175	0.651	0.14
Total	0.145	0.075	0.083	0.037	0.119	100.00

Notes:

1. All statistics are weighted by establishment. See text for details.

Table 2B

Vacancy Incidence: Proportion Reporting Vacancies by Employment

	Vacancy Incidence by Employment					
	any vacancies	any h2f vacancies	any nh2f vacancies	any ss vacancies	any nss vacancies	%
Panel A: Aggregate						
Total	0.442	0.221	0.325	0.107	0.393	100.0
Panel B: by Region						
Eastern	0.453	0.266	0.303	0.106	0.391	10.44
East Midlands	0.403	0.189	0.311	0.096	0.361	7.99
London	0.481	0.223	0.378	0.125	0.436	17.86
North-East	0.402	0.184	0.294	0.091	0.351	4.56
North-West	0.393	0.179	0.312	0.101	0.358	12.94
South-East	0.492	0.278	0.331	0.118	0.433	16.32
South-West	0.463	0.231	0.319	0.096	0.412	9.50
West Midlands	0.436	0.210	0.327	0.115	0.387	10.79
Yorks & Humberside	0.375	0.178	0.287	0.081	0.331	9.60
Total	0.442	0.221	0.325	0.107	0.393	100.0
Panel C: by Industry						
1.agriculture	0.213	0.100	0.137	0.035	0.186	1.15
2. mining & quarrying	0.239	0.208	0.084	0.016	0.223	0.23
3. manufacturing	0.398	0.192	0.298	0.106	0.344	17.33
4. elect'y & water supply	0.650	0.240	0.574	0.210	0.605	0.34
5. construction	0.277	0.164	0.151	0.098	0.202	4.26
6. wholesale, retail	0.365	0.142	0.273	0.055	0.331	17.54
7. hotels and restaurants	0.436	0.200	0.318	0.056	0.412	5.59
8. transport & comm..	0.512	0.234	0.398	0.103	0.474	5.89
9. finance	0.467	0.150	0.382	0.078	0.420	4.48
10. business services	0.449	0.230	0.317	0.147	0.377	15.04
11. public administration	0.572	0.295	0.486	0.178	0.537	5.73
12. education	0.503	0.289	0.342	0.097	0.455	7.33
13. health & social work	0.596	0.408	0.419	0.175	0.538	10.34
14. other community	0.370	0.151	0.275	0.067	0.336	4.75
Total	0.442	0.221	0.325	0.107	0.393	100.0
Panel D: by Sector						
Private sector	0.409	0.195	0.293	0.095	0.358	71.82
Public sector	0.540	0.300	0.422	0.143	0.499	24.51
Voluntary sector	0.455	0.239	0.325	0.097	0.410	2.99
Total	0.442	0.221	0.325	0.107	0.393	100.0
Panel E: by Est. Size						
1-4	0.104	0.055	0.056	0.029	0.083	10.85
5-9	0.169	0.086	0.092	0.036	0.139	7.16
10-24	0.275	0.143	0.153	0.060	0.227	15.09
25-49	0.365	0.176	0.236	0.075	0.317	12.52
50-99	0.482	0.246	0.314	0.112	0.415	13.19
100-199	0.561	0.251	0.424	0.117	0.506	10.03
200-499	0.642	0.276	0.533	0.132	0.598	15.66
500+	0.714	0.418	0.595	0.229	0.653	15.50
Total	0.442	0.221	0.325	0.107	0.393	100.00

Notes:

1. All statistics are weighted by employment. See text for details.

Table 3A

Vacancy Rates by Establishment

	Vacancy Rate by Establishment					
	total vacancies	h2f vacancies	non-h2f vacancies	ss vacancies	non-ss vacancies	%
Panel A: Aggregate						
Total	0.042	0.021	0.021	0.010	0.032	100.00
Panel B: by Region						
Eastern	0.056	0.023	0.033	0.017	0.039	11.35
East Midlands	0.036	0.011	0.024	0.005	0.031	7.85
London	0.057	0.028	0.029	0.011	0.046	18.57
North-East	0.027	0.016	0.011	0.009	0.018	3.50
North-West	0.032	0.019	0.013	0.012	0.020	11.96
South-East	0.040	0.022	0.018	0.008	0.032	17.81
South-West	0.041	0.022	0.019	0.015	0.026	10.50
West Midlands	0.046	0.027	0.019	0.009	0.037	9.75
Yorks & Humberside	0.023	0.010	0.012	0.005	0.017	8.72
Total	0.042	0.021	0.021	0.010	0.032	100.00
Panel C: by Industry						
1.agriculture	0.022	0.019	0.003	0.003	0.018	2.97
2. mining & quarrying	0.002	0.001	0.001	0.000	0.002	0.16
3. manufacturing	0.031	0.011	0.020	0.007	0.023	8.85
4. elect'y & water supply	0.019	0.008	0.011	0.007	0.012	0.09
5. construction	0.032	0.020	0.012	0.014	0.018	9.16
6. wholesale, retail	0.043	0.018	0.025	0.006	0.037	23.32
7. hotels and restaurants	0.034	0.021	0.013	0.008	0.026	7.00
8. transport & comm..	0.052	0.020	0.031	0.010	0.042	4.45
9. finance	0.057	0.025	0.032	0.012	0.044	2.13
10. business services	0.055	0.030	0.025	0.017	0.038	25.06
11. public administration	0.018	0.004	0.014	0.002	0.016	1.00
12. education	0.026	0.013	0.013	0.003	0.023	2.28
13. health & social work	0.044	0.022	0.022	0.009	0.034	4.37
14. other community	0.040	0.022	0.018	0.011	0.030	9.18
Total	0.042	0.021	0.021	0.010	0.032	100.00
Panel D: by Sector						
Private sector	0.042	0.022	0.020	0.011	0.031	85.70
Public sector	0.034	0.011	0.023	0.005	0.030	8.85
Voluntary sector	0.064	0.021	0.042	0.018	0.046	4.72
Total	0.042	0.021	0.021	0.010	0.032	100.00
Panel E: by Est. Size						
1-4	0.047	0.024	0.024	0.012	0.035	71.95
5-9	0.030	0.015	0.015	0.006	0.024	11.06
10-24	0.031	0.016	0.016	0.007	0.025	9.86
25-49	0.027	0.012	0.015	0.005	0.022	3.69
50-99	0.027	0.013	0.014	0.005	0.022	2.02
100-199	0.024	0.009	0.015	0.004	0.020	0.75
200-499	0.020	0.007	0.014	0.002	0.018	0.53
500+	0.021	0.007	0.014	0.003	0.018	0.14
Total	0.042	0.021	0.021	0.010	0.032	100.00

Notes:

1. All statistics are weighted by establishment. See text for details.

Table 3B

Vacancy Rates by Employment

	Vacancy Rate by Employment					
	total vacancies	h2f vacancies	non-h2f vacancies	ss vacancies	non-ss vacancies	%
Panel A: Aggregate						
Total	0.027	0.012	0.015	0.005	0.022	100.0
Panel B: by Region						
Eastern	0.031	0.016	0.015	0.007	0.024	10.48
East Midlands	0.022	0.008	0.014	0.003	0.019	7.99
London	0.032	0.013	0.019	0.006	0.026	17.89
North-East	0.019	0.007	0.012	0.003	0.015	4.56
North-West	0.021	0.009	0.012	0.004	0.017	12.95
South-East	0.035	0.018	0.017	0.007	0.028	16.25
South-West	0.028	0.014	0.015	0.005	0.023	9.51
West Midlands	0.024	0.010	0.013	0.005	0.019	10.77
Yorks & Humberside	0.018	0.007	0.011	0.003	0.016	9.59
Total	0.027	0.012	0.015	0.005	0.022	100.0
Panel C: by Industry						
1.agriculture	0.028	0.018	0.010	0.004	0.024	1.15
2. mining & quarrying	0.010	0.002	0.007	0.000	0.010	0.23
3. manufacturing	0.017	0.007	0.010	0.004	0.013	17.33
4. elect'y & water supply	0.020	0.007	0.013	0.005	0.015	0.34
5. construction	0.027	0.016	0.011	0.010	0.017	4.26
6. wholesale, retail	0.025	0.010	0.015	0.004	0.021	17.54
7. hotels and restaurants	0.041	0.018	0.024	0.004	0.037	5.59
8. transport & comm..	0.030	0.014	0.017	0.005	0.026	5.89
9. finance	0.025	0.008	0.017	0.004	0.021	4.48
10. business services	0.037	0.018	0.020	0.009	0.028	15.04
11. public administration	0.021	0.006	0.015	0.002	0.018	5.73
12. education	0.018	0.009	0.010	0.003	0.015	7.33
13. health & social work	0.032	0.017	0.015	0.006	0.026	10.34
14. other community	0.032	0.014	0.018	0.006	0.026	4.75
Total	0.027	0.012	0.015	0.005	0.022	100.0
Panel D: by Sector						
Private sector	0.028	0.013	0.015	0.006	0.022	71.82
Public sector	0.022	0.009	0.013	0.003	0.019	24.51
Voluntary sector	0.041	0.017	0.024	0.007	0.034	2.99
Total	0.027	0.012	0.015	0.005	0.022	100.0
Panel E: by Est. Size						
1-4	0.045	0.022	0.022	0.011	0.034	10.85
5-9	0.030	0.015	0.015	0.006	0.024	7.16
10-24	0.031	0.015	0.015	0.006	0.025	15.09
25-49	0.026	0.012	0.015	0.004	0.022	12.52
50-99	0.027	0.013	0.013	0.005	0.021	13.19
100-199	0.024	0.009	0.015	0.004	0.020	10.03
200-499	0.020	0.007	0.013	0.002	0.018	15.66
500+	0.019	0.007	0.012	0.003	0.016	15.50
Total	0.027	0.012	0.015	0.005	0.022	100.00

Notes:

1. All statistics are weighted by employment. See text for details.

Table 4

Vacancy Frequencies and Vacancy Rates by Establishment Size:

All Vacancies

	Establishment Size								
%	1-4	5-9	10-24	25-49	50-99	100-199	200-499	500+	All %
number of vacancies									
none	90.31	83.65	73.61	63.92	52.20	44.64	36.44	29.45	85.47
1	6.22	10.42	11.84	11.84	10.29	6.81	3.92	1.01	7.51
2	2.08	4.42	8.32	10.60	11.82	8.85	6.64	2.67	3.54
3	0.86	0.87	3.15	5.33	7.21	7.85	5.41	2.50	1.46
4	0.39	0.26	1.16	3.33	5.47	6.13	5.15	2.41	0.73
5 to 9	0.10	0.25	1.40	3.56	8.94	15.42	17.89	11.27	0.77
10 or more	0.04	0.14	0.52	1.42	4.07	10.32	24.54	50.69	0.51
total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Proportion reporting some vacancies	0.097	0.163	0.264	0.361	0.478	0.554	0.635	0.705	0.145
Mean number of vacancies for those with some vacancies	1.59	1.65	2.35	2.91	4.14	6.51	10.0	31.9	2.57
Mean vacancy rate for those with some vacancies	0.488	0.183	0.119	0.074	0.056	0.043	0.032	0.029	0.291
Mean overall vacancy rate	0.047	0.030	0.031	0.027	0.027	0.024	0.020	0.021	0.042

Notes:

1. All statistics are weighted by establishment. See text for details.

Table 5A

Decomposition of Unconditional Vacancy Rate Variances by Sub-categories

All Establishments

Sub-category:	total	%	within	%	between	%
by region[1]	0.01814	100.0	0.01802	99.3	0.00012	0.7
by business type[2]	0.01814	100.0	0.01804	99.4	0.00010	0.6
by sector[3]	0.01814	100.0	0.01811	99.8	0.00003	0.2
by establishment size[4]	0.01814	100.0	0.01807	99.6	0.00007	0.4
by LLSC area[5]	0.01814	100.0	0.01747	96.3	0.00067	3.7

Table 5B

Decomposition of Conditional Vacancy Rate Variances by Sub-categories

Establishments with v > 0

Sub-category:	total	%	within	%	between	%
by region[1]	0.05235	100.0	0.05062	96.7	0.00173	3.3
by business type[2]	0.05235	100.0	0.04590	87.7	0.00645	12.3
by sector[3]	0.05235	100.0	0.05014	95.8	0.00221	4.2
by establishment size[4]	0.05235	100.0	0.01517	29.0	0.03718	71.0
by LLSC area[5]	0.05235	100.0	0.04459	85.2	0.00775	14.8

Notes:

1. Region: 9 categories: Eastern; East Midlands; London; North-East; North-West; South-East; South-West; West Midlands; and Yorkshire and Humberside.
2. Business type: 14 categories: agriculture; mining & quarrying; manufacturing; electricity and water supply; construction; wholesale and retail; hotels and restaurants; transport and communication; finance; business services; public administration; education; health and social work; and other community.
3 Sector: 3 categories: private sector; public sector; and voluntary sector.
4. Establishment size: 8 categories: 1-4; 5-9; 10-24; 25-49; 50-99; 100-199, 200-499; and 500 or more workers.
5. LLSC area: 47 categories: 47 local Learning and Skills Council areas.

Table 6

Determinants of Vacancy Incidence and Rate: All Vacancies

	(1) Vacancy Incidence: Probit			(2) Vacancy Propensity: Truncated			(3) Overall Marginal Effects		
Specification:	(A)	(B)	(C)	(A)	(B)	(C)	(A)	(B)	(C)
esize2$	0.058***	0.062***	0.062***	-0.216***	-0.208***	-0.207***	-0.0096	-0.0072	-0.0071
	(0.008)	(0.008)	(0.008)	(0.004)	(0.004)	(0.004)			
esize3$	0.151***	0.159***	0.159***	-0.291***	-0.280***	-0.275***	0.0047	0.0083	0.0091
	(0.010)	(0.010)	(0.010)	(0.004)	(0.004)	(0.004)			
esize4$	0.248***	0.257***	0.258***	-0.377***	-0.364***	-0.355***	0.0189	0.0229	0.0243
	(0.017)	(0.017)	(0.018)	(0.006)	(0.006)	(0.006)			
esize5$	0.370***	0.377***	0.381***	-0.435***	-0.422***	-0.412***	0.0417	0.0458	0.0480
	(0.024)	(0.024)	(0.025)	(0.009)	(0.009)	(0.008)			
esize6$	0.443***	0.448***	0.455***	-0.498***	-0.485***	-0.474***	0.0525	0.0562	0.0592
	(0.038)	(0.038)	(0.039)	(0.016)	(0.015)	(0.015)			
esize7$	0.533***	0.538***	0.554***	-0.591***	-0.576***	-0.565***	0.0639	0.0681	0.0733
	(0.044)	(0.044)	(0.044)	(0.023)	(0.022)	(0.021)			
esize8$	0.621***	0.620***	0.628***	-0.614***	-0.600***	-0.587***	0.0826	0.0852	0.0887
	(0.078)	(0.079)	(0.079)	(0.043)	(0.042)	(0.041)			
private$	0.013**	0.013**	0.021***	-0.028***	-0.023***	-0.033***	0.0001	0.0006	0.0016
	(0.006)	(0.006)	(0.006)	(0.003)	(0.003)	(0.004)			
foreign$	-0.024**	-0.029***	-0.028***	0.019***	0.014**	0.013**	-0.0037	-0.0056	-0.0053
	(0.009)	(0.009)	(0.009)	(0.006)	(0.006)	(0.006)			
single$	-0.034***	-0.037***	-0.032***	0.026***	0.025***	0.023***	-0.0055	-0.0063	-0.0053
	(0.006)	(0.006)	(0.006)	(0.003)	(0.003)	(0.003)			
increase$	0.088***	0.081***	0.080***	0.041***	0.042***	0.042***	0.0255	0.0240	0.0237
	(0.008)	(0.007)	(0.007)	(0.003)	(0.003)	(0.003)			
decrease$	-0.047***	-0.046***	-0.045***	0.006	0.014**	0.015**	-0.0107	-0.0096	-0.0091
	(0.008)	(0.008)	(0.008)	(0.007)	(0.007)	(0.007)			
hire rate	0.043***	0.042***	0.043***	0.009***	0.010***	0.012***	0.0112	0.0113	0.0116
	(0.004)	(0.004)	(0.004)	(0.002)	(0.002)	(0.002)			
quit rate	0.022***	0.021***	0.022***	0.011***	0.009***	0.008***	0.0064	0.0061	0.0061
	(0.004)	(0.004)	(0.004)	(0.002)	(0.002)	(0.002)			
train1$	0.039***	0.039***	0.039***	-0.032***	-0.038***	-0.035***	0.0058	0.0053	0.0056
	(0.008)	(0.008)	(0.008)	(0.004)	(0.004)	(0.004)			
train2$	0.063***	0.061***	0.060***	-0.037***	-0.039***	-0.035***	0.0111	0.0105	0.0108
	(0.008)	(0.008)	(0.008)	(0.004)	(0.003)	(0.003)			

	(1) Vacancy Incidence: Probit			(2) Vacancy Propensity: Truncated			(3) Overall Marginal Effects		
Specification:	(A)	(B)	(C)	(A)	(B)	(C)	(A)	(B)	(C)
train3$	0.064***	0.061***	0.058***	0.033***	0.029***	0.033***	0.0190	0.0177	0.0175
	(0.007)	(0.007)	(0.007)	(0.003)	(0.003)	(0.003)			
head office$	-0.011	-0.017**	-0.014*	0.025***	0.026***	0.026***	0.0000	-0.0014	-0.0007
	(0.008)	(0.007)	(0.008)	(0.005)	(0.005)	(0.005)			
industry empl.		0.068**	0.036		0.026	0.029		0.0190	0.0117
		(0.029)	(0.053)		(0.017)	(0.030)			
low skills		0.516***	0.548***		0.178**	0.230***		0.1431	0.1561
		(0.121)	(0.121)		(0.074)	(0.073)			
high skills		0.081	0.095		-0.167***	-0.110**		0.0016	0.0112
		(0.090)	(0.089)		(0.053)	(0.053)			
empl. growth		0.084	0.100*		0.154***	0.131***		0.0366	0.0380
		(0.057)	(0.056)		(0.033)	(0.032)			
rel. wage		0.104***	0.097***		0.035**	0.029*		0.0286	0.0264
		(0.026)	(0.026)		(0.016)	(0.015)			
ND_partic.		0.650***	0.636***		0.299***	0.283***		0.1880	0.1829
		(0.092)	(0.092)		(0.057)	(0.056)			
ND_efficacy		0.032	0.050		-0.186***	-0.222***		-0.0122	-0.0115
		(0.118)	(0.118)		(0.066)	(0.065)			
log(ilo_rate)		-0.106***	-0.106***		-0.041***	-0.045***		-0.0299	-0.0303
		(0.012)	(0.012)		(0.007)	(0.007)			
Constant				0.365***	0.332***	0.347***			
				(0.004)	(0.046)	(0.047)			
industry dums.	no	no	yes	no	no	yes	no	no	yes
Observations	25795	25795	25795	8878	8878	8878			

Notes:

1. $ denotes dummy variable.
2. * denotes significant at 10%; ** significant at 5%; *** significant at 1%.
3. The marginal effects of the regressors are reported in each case (see text for detail).

Table 7

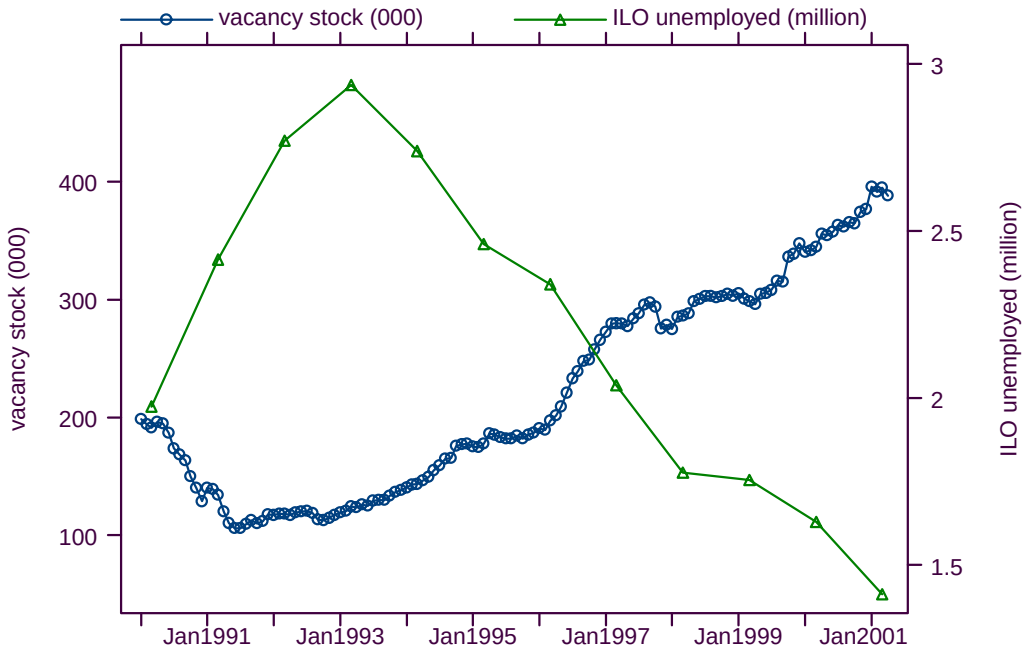
Vacancies and Alternative Measures of the Unemployment Rate (using Specification C)

	total vacancies			hard-to-fill vacancies			non-hard-to-fill vacancies			skill-shortage vacancies			non-skill-shortage vacancies		
unemployment measure:	vacancy incidence	vacancy rate	marginal effect	vacancy incidence	vacancy rate	marginal effect	vacancy incidence	vacancy rate	marginal effect	vacancy incidence	vacancy rate	marginal effect	vacancy incidence	vacancy rate	marginal effect
log(ilo_urate)	-0.106*** (0.012)	-0.045*** (0.007)	-0.0303	-0.045*** (0.008)	0.008 (0.010)	-0.0101	-0.067*** (0.009)	-0.054*** (0.009)	-0.0173	-0.014** (0.005)	-0.037*** (0.012)	-0.0041	-0.084*** (0.011)	-0.049*** (0.007)	-0.0229
log(urate)	-0.098*** (0.013)	-0.021*** (0.007)	-0.0260	-0.063*** (0.009)	-0.021** (0.009)	-0.0157	-0.035*** (0.009)	0.002 (0.008)	-0.0074	-0.013** (0.006)	-0.045*** (0.013)	-0.0041	-0.077*** (0.011)	-0.017** (0.007)	-0.0187
log(lturate)	-0.075*** (0.011)	-0.011** (0.006)	-0.0193	-0.049*** (0.017)	-0.010 (0.008)	-0.0118	-0.027*** (0.008)	0.004 (0.007)	-0.0055	-0.009* (0.005)	-0.035*** (0.011)	-0.0029	-0.057*** (0.010)	-0.010* (0.006)	-0.0138
log(nonempr)	-0.145*** (0.025)	-0.040*** (0.013)	-0.0394	-0.051*** (0.017)	0.005 (0.018)	-0.0116	-0.100*** (0.018)	-0.057*** (0.016)	-0.0249	0.003 (0.011)	0.028 (0.025)	0.0013	-0.143*** (0.022)	-0.072*** (0.014)	-0.0384

Notes:
1. * denotes significant at 10%; ** significant at 5%; *** significant at 1%.
2. all specifications also include the other control variables used in Table 6, Specification C.

Figure 1

Notified Vacancies and ILO Unemployment in the UK: January 1990-April 2001



Source:
1. Vacancy stock: Employment Service administrative system, monthly, seasonally adjusted.
2. ILO Unemployment: LFS Spring Quarters, seasonally adjusted.

Figure 2

Number of Vacancies by Establishment Size: All Vacancies

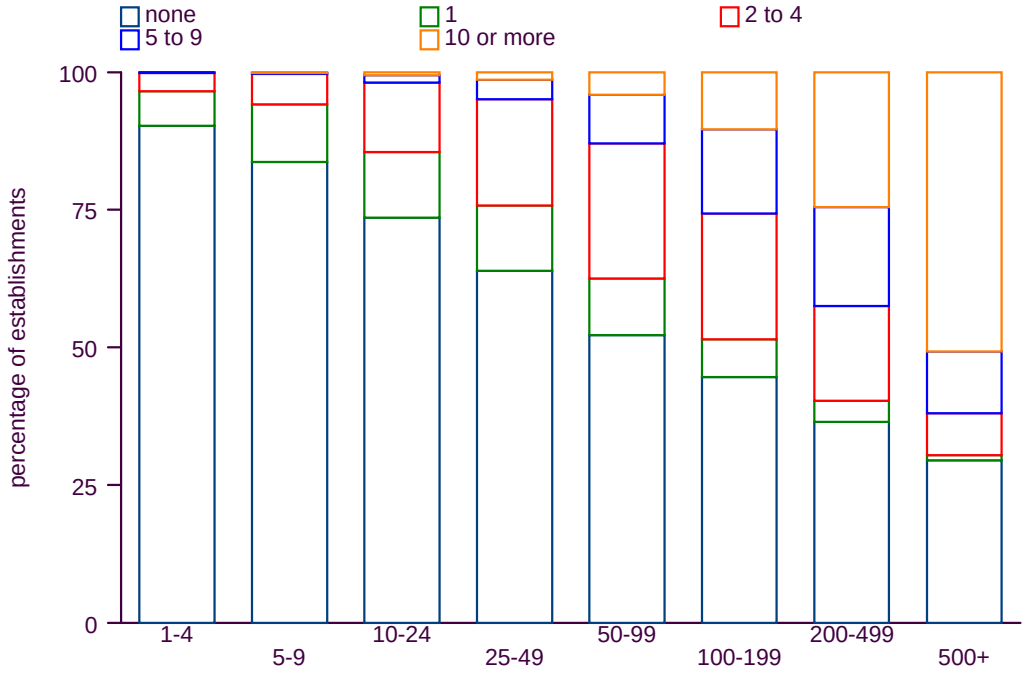


Figure 3

Number of Vacancies by Establishment Size: Hard-to-Fill Vacancies

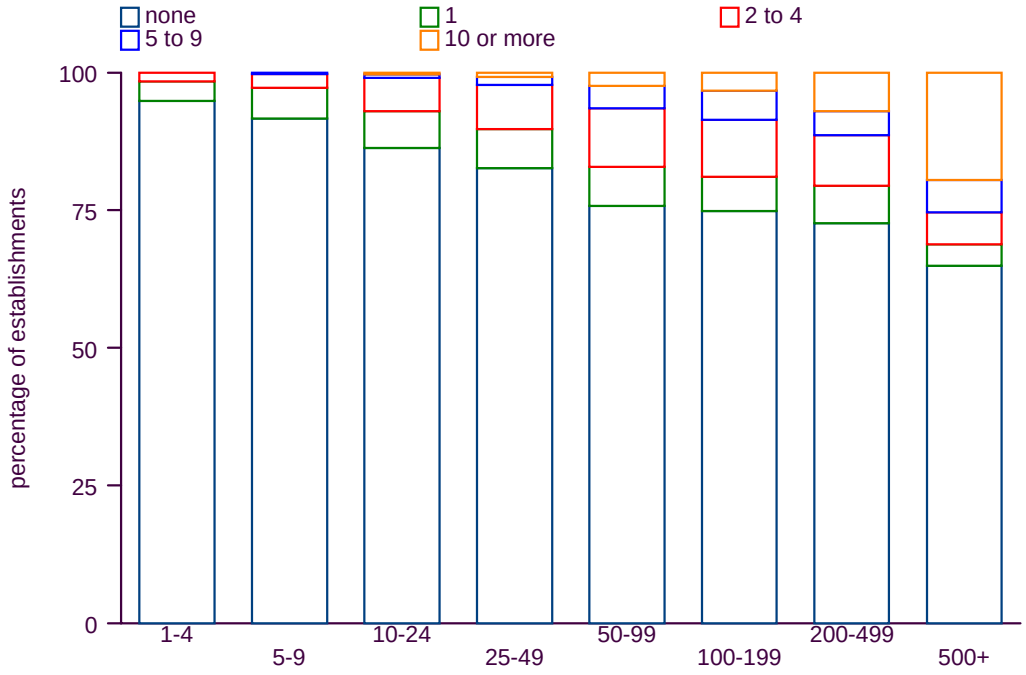
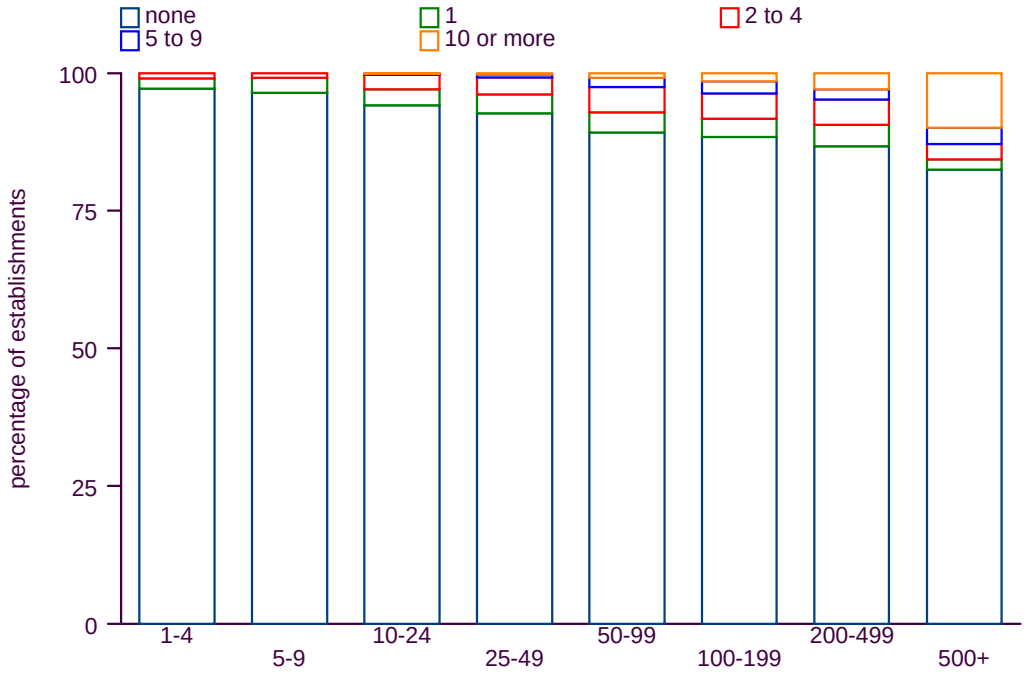


Figure 4

Number of Vacancies by Establishment Size: Skill-Shortage Vacancies



ANNEX A

Table A1

Variable Descriptions and Summary Statistics

Variable:	Description:	mean	sd
any vacancies$	any vacancies at the establishment	0.1453	0.3524
any h2f vacancies$	any hard-to-fill vacancies at the establishment	0.0750	0.2633
any non-h2f vacs.$	any non-hard-to-fill vacancies at the establishment	0.0835	0.2766
any ss vacancies$	any skill shortage vacancies at the establishment	0.0371	0.1891
any non-ss vacs.$	any non-skill-shortage vacancies at the establishment	0.1192	0.3241
vr all	vacancy rate, all vacancies	0.0423	0.1347
vr h2f	vacancy rate, hard-to-fill vacancies	0.0211	0.0964
vr non-h2f	vacancy rate, non-hard-to-fill vacancies	0.0212	0.0930
vr ss	vacancy rate, skill-shortage vacancies	0.0105	0.0665
vr non-ss	vacancy rate, non-skill-shortage vacancies	0.0312	0.1127
esize1$	establishment size 1-4 (base)	0.7195	0.4493
esize2$	establishment size 5-9	0.1106	0.3136
esize3$	establishment size 10-24	0.0986	0.2982
esize4$	establishment size 25-49	0.0369	0.1885
esize5$	establishment size 50-99	0.0202	0.1406
esize6$	establishment size 100-199	0.0075	0.0864
esize7$	establishment size 200-499	0.0053	0.0727
esize8$	establishment size 500+	0.0014	0.0376
private$	private sector	0.8570	0.3501
foreign$	foreign or joint UK/foreign owned	0.0328	0.1386
single$	single establishment organisation	0.7252	0.4464
increase$	total sales/budget increased a great deal in last year	0.1242	0.3299
decrease$	total sales/budget decreased a great deal in last year	0.0514	0.2207
hire rate	number hired in last year as fraction of workforce	0.3230	0.7082
quit rate	number left in last year as fraction of workforce	0.2969	0.7277
train0$	no off-the-job training in last year (base)	0.6296	0.4836
train1$	off-the-job training for 1-20% of employees in last year	0.0876	0.2827
train2$	off-the-job training for 20-80% of employees in last year	0.1114	0.3146
train3$	off-the-job training for 80-100% of employees in last year	0.1646	0.3709
head office$	establishment is head office of multi-establishment firm	0.0700	0.2551
industry empl.	LLSC share of industry employment: source LFS	0.1237	0.0706
low skills	LLSC proportion of working age with no qualifications	0.1542	0.0377
high skills	LLSC proportion of working age with NVQ4+	0.2376	0.0555
empl. growth	LLSC employment growth in last 2 years: source ABI	0.0291	0.0485
rel. wage	LLSC weighted relative wage: source NES/LFS	1.0144	0.1486
ND_partic.	LLSC ND participation: ND participants as % total unempl.	0.3864	0.0452
ND_efficacy	LLSC ND efficacy: jobs as a proportion of ND participants	0.3069	0.0431
log(ilo_urate)	log of LLSC ILO unemployment rate	1.5515	0.3698
log(urate)	log of LLSC claimant count unemployment rate	1.0725	0.4615
log(lturate)	log of LLSC long-term (> 6 months) unemployment rate	0.0484	0.5827
log(nonempr)	log of LLSC working age non-employment rate	3.1910	0.2002
industry dums.$	14 industry dummies	-	-

Notes:
1. All statistics are establishment-weighted.
2. $ denotes dummy variable.